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U.S. NAVY WATERSIDE SECURITY SYSTEM TECHNOLOGY UPDATE

by

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SYSTEM DESCRIPTION

The mission of the Waterside Security System (WSS) is to protect critical waterside installations and ships in port against waterborne intrusions. The WSS provides both surface and subsurface surveillance to detect scuba and surface swimmers, low and high speed surface craft, and swimmer delivery vehicles. The WSS functions as a stand-alone system, as part of the base installation security system, or in conjunction with the Shipboard Physical Security System.

Surface and subsurface targets are automatically detected, tracked, and analyzed by radar/sonar and associated processors. Information about the targets (e.g., location, speed, and bearing) is sent to a Command, Control, Communications and Display (C3D) element and is further analyzed using a series of alerting algorithms. When a tracked target violates a warning threshold, the C3D operator is alerted. The operator evaluates the threat based on its behavior (speed and path) and visual appearance as viewed through associated Visual Imaging Sensor (VIS) and Thermal Imaging Sensor (TIS) assessment cameras. If the operator concludes that a target is hostile, an alarm is communicated via telephone or radio link to other base security facilities responsible for threat deterrence and response. The operator may also activate high intensity spotlights to assist response forces in locating the threat in darkness.

OBJECTIVE

A primary WSS objective was to satisfy the U.S. Navy's operational requirement while emphasizing the use of non-developmental items (NDI) wherever possible to minimize development time and cost. If NDI could not satisfy established system requirements the appropriate technology would be provided through a research and development effort. Earlier testing of candidate NDI equipment revealed that existing sonars and C3D with appropriate characteristics were not available.

Another WSS objective has been to minimize the number and skill level of system operators. The system is operated by one person. This requires that the detection devices be intelligent enough to automatically alert the operator when a threat-like intrusion is detected within or near a secure perimeter.

SYSTEM CONFIGURATION

The WSS consists primarily of non-developmental items that are commercially available with the exception of portions of the sonar and the C3D software. The WSS includes five major elements, C3D, Radar, Sonar, Imaging, and Power Distribution and Fiber Optics Interface (PD/FOI). The quantity of components to be installed at any particular site will be tailored to fit local topographical conditions affecting sensor coverage.

Each WSS site may have different multiples of sensors to ensure adequate coverage in establishing a secure perimeter against waterborne threats.

COMMAND, CONTROL, COMMUNICATIONS AND DISPLAY (C3D)

The C3D element integrates sensor signals from other WSS elements, providing centralized management of display and control function at a single operator console located in a central control room. The C3D is a computer based element which provides automatic threat detection based on predetermined security criteria. The C3D provides a large, high resolution color graphics situation display in the form of a map of the protected site upon which processed target data is overlaid. The situation display provides the operator with information such as: site layout, target data, and response force data. The C3D assists the operator with initial, rapid assessment by selecting and positioning the most appropriate imaging device. The C3D also assists response forces by computing relative range and bearing between locations indicated by the operator on the situation display and by rapidly establishing voice communications and alarm contacts with Base Security and other security systems. The C3D consists primarily of commercially available hardware and special purpose software.

RADAR

The radar element provides the primary means of automatically detecting surface crafts. The radar element contains the following four major components: the scanner, the local display, the local radar track processor (LRTP) and the rectifier. The scanner includes the antenna and radar receiver/transmitter. The local display provides control and display for the radar set. Together, the scanner and local display make up the radar set. The LRTP performs scan-conversion and tracking on the radar video and the rectifier provides DC power to the radar set.

Baseband radar video from the radar set is processed by the LRTP. The LRTP first performs an automatic detection process and then performs automatic track processing of any detections. Track files from the LRTP are communicated to the C3D by an RS-232 interface. The C3D presents the tracks to the operator on the situation display. The LRTP also performs scan-conversion of the radar signal to RS-170 video so that it is available for display at the C3D.

The LRTP allows the target acquisition zone to be customized for each site based upon local geography and typical port activity. Tracks can only be initiated while within this zone. A WSS installation would allow overlapping coverage in most areas and provide fault tolerance. The C3D performs the track correlation process within the global radar/sonar track processor. Thus, a single target would not present more than one track to the WSS operator.

SONAR

The sonar element provides the primary means of automatically detecting subsurface targets. The sonar operates in pulse mode to detect underwater targets. The C3D automatically alerts the operator when a sonar track has exceeded a designated confidence level. Tracks exceeding the preset confidence level are sent to the global radar/sonar track processor at the C3D for follow-up correlation analysis. As in the case of radar, validated targets may be viewed as symbols on the C3D situation display.

The sonar is designed around powerful programmable signal processing components. The modular architecture of the multi-function signal processing boards and the Versa Module European (VME) bus structure lend themselves to hardware and software upgrades as technology advances. The sonar signal processing and display unit is composed of circuit boards designed specifically for the WSS and other boards which are commercially available.

IMAGING

The WSS Imaging element consists of the Visual Imaging Sensor (VIS), Thermal Imaging Sensor (TIS), Spotlight Assembly, and Azimuth-Elevation (AZ-EL) Assembly.

The AZ-EL serves as a movable, remotely controlled platform to position the VIS, TIS and Spotlight units. The imaging equipment is mounted atop a support tower. Raster scan video from the VIS closed circuit television (CCTV) camera and the TIS Forward Looking Infrared (FLIR) camera is sent to the C3D operator console for display on black-white monitors. Cameras may be automatically aimed by the C3D or manual override may be exercised by the operator, using a joystick positioning control.

POWER DISTRIBUTION AND FIBER OPTIC INTERFACE

The power distribution and fiber optic interface connects WSS elements to the C3D and provides the following support functions:

- a. Primary commercial power conditioning and distribution.
- b. Battery back-up power serving as an uninterruptible power supply.
- c. Voice intercommunications between the remote sensor sites

and the C3D operator console.

d. Status condition for display at C3D operator console.

e. Fiber optic cable and signal interfaces providing data links between remote sensor sites and the C3D.

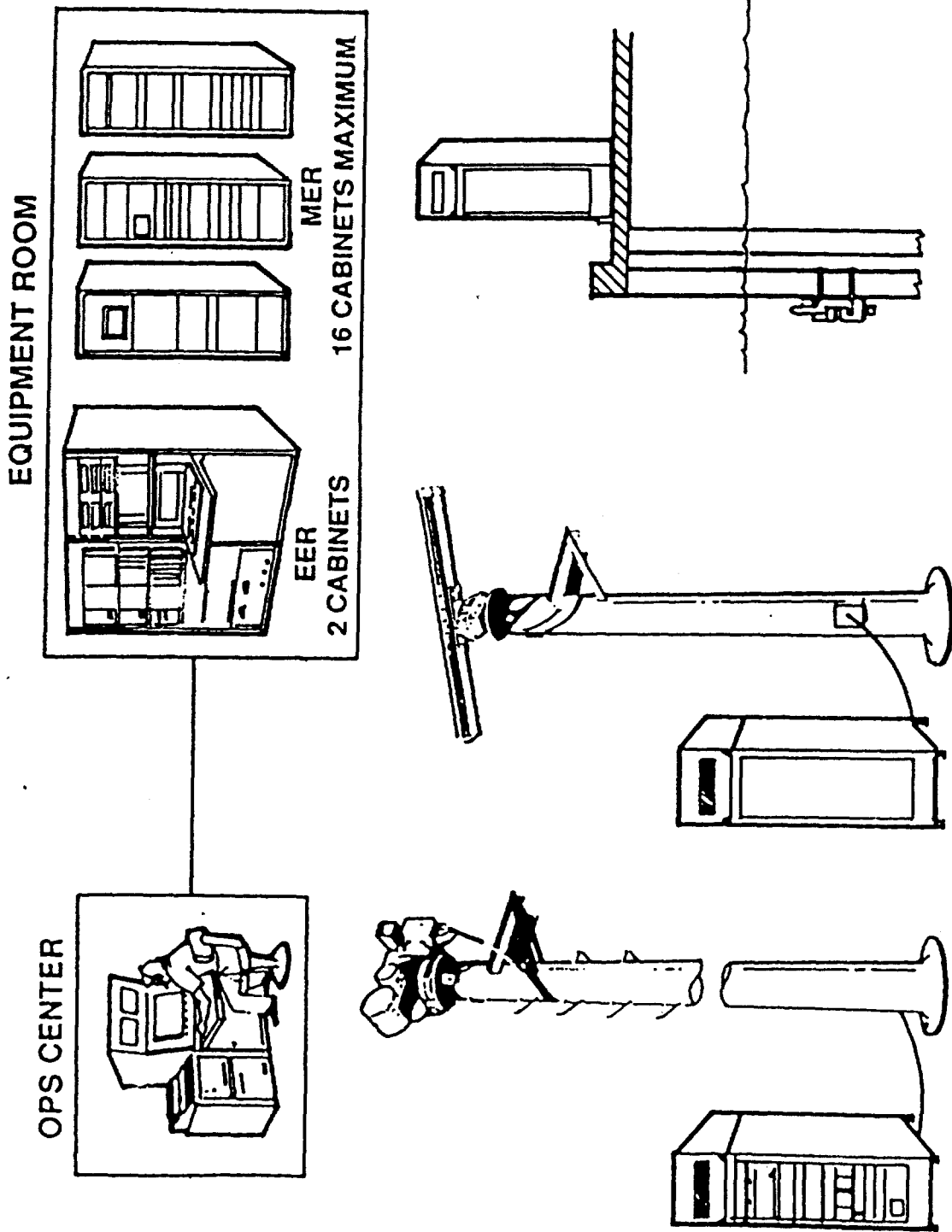
WSS PROGRAM SUMMARY

The Waterside Security System has recently received approval for low rate initial production. Planned improvements to the baseline system include developing a rapidly deployable configuration and adding a delay or response capability.

SUMMARY

The Waterside Security System provides an effective means for automatically detecting and assessing waterborne intruders. This multi-sensor system is based primarily upon non-developmental items and has been supplemented by special purpose software and hardware developed for this application. Improvements are planned to increase the capability of the baseline WSS.

WATERSIDE SECURITY SYSTEM DIAGRAM OF SYSTEM



REMOTE SENSOR SITES

CONFIGURATION WILL BE TAILORED TO THE INDIVIDUAL REQUIREMENTS
OF EACH SITE